Update of Kalman Fitlering work on SVX

Hua Pei
Iowa State University
Oct 13, 2004

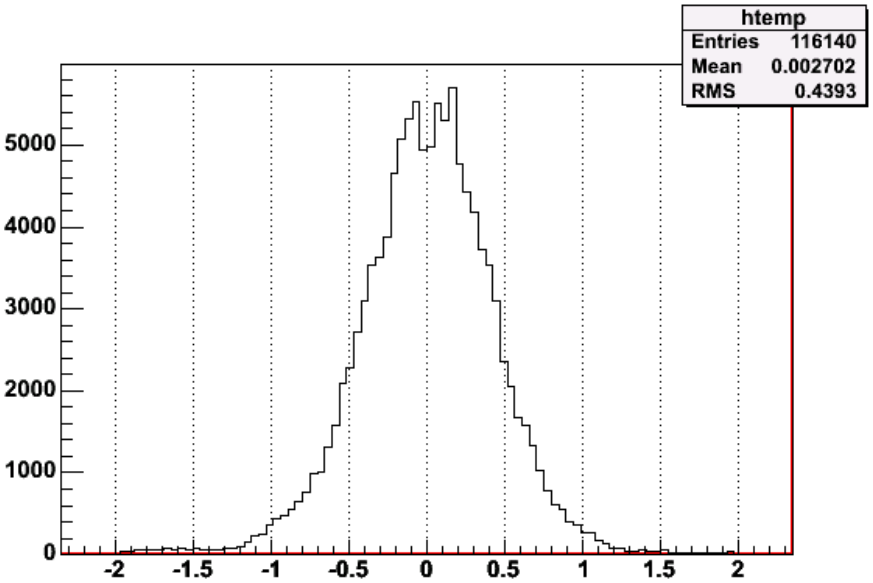
Adding multi-scattering effect to Kalman Fitting

In the previous work, we have been weighting the hits using the detector resolution only. However, since the resolution of DC/PC1 is not so worse than SVX, while they are much farther away. The multi-scattering happens at SVX should affect DC/PC1, and their weight should be re-evaluated other than resolution.

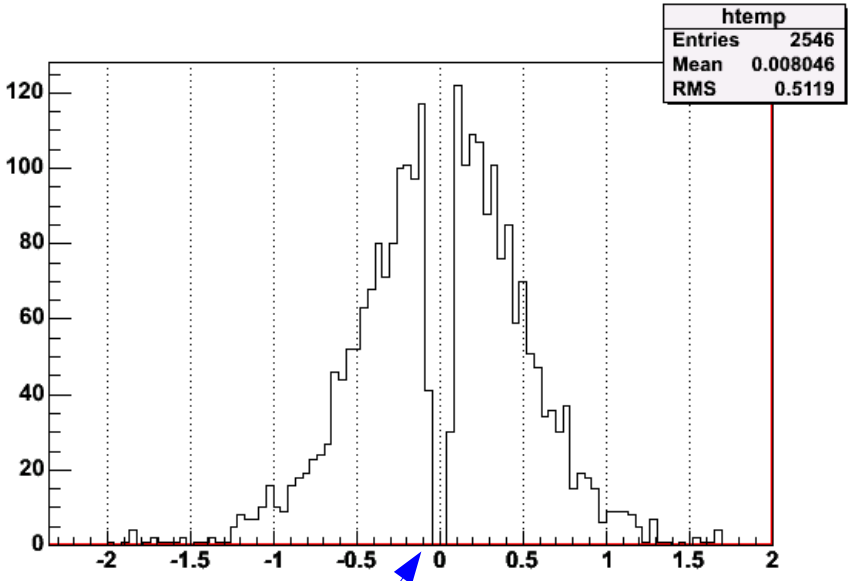
This is done by using Zero-field simulation. A bunch of pi+ are sent along x-axis, and the y-position of the GEANT hits are seized. Without multi-scattering, we should have got exactly Zero.

From MC simulation we find that the σ_{ms} is bigger than the resolution of DC and PC1, and bigger than the level of SVX resolution, too.

Therefore, we use σ_{ms} to decide the detector weight on Central Arm (DC & PC1), while SVX still depends on detector resolution only.



y-position (cm) of DC hits
DC resolution = 0.0165cm



y-position (cm) of PC1 hits
PC1 resolution = 0.17cm

This can be caused by gap between two panels

Redo the Simulation with New Weight in Kalman Fitting

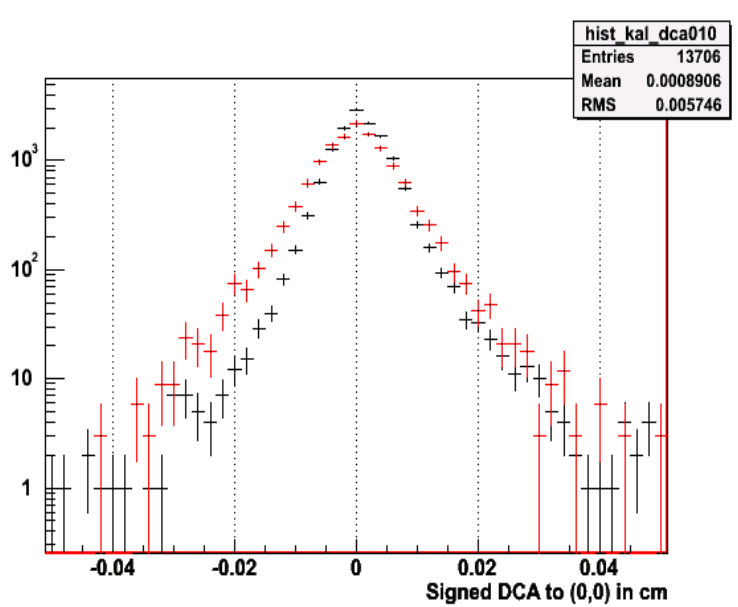
The following pages show the update. I will be using 3 kinds of PISA events: single pi+, single D^0, and EXODUS. For each of them, I will apply pisaToDST and Kalman Fitting. The DCA of reconstruced tracks will be compared.

Track Cut:

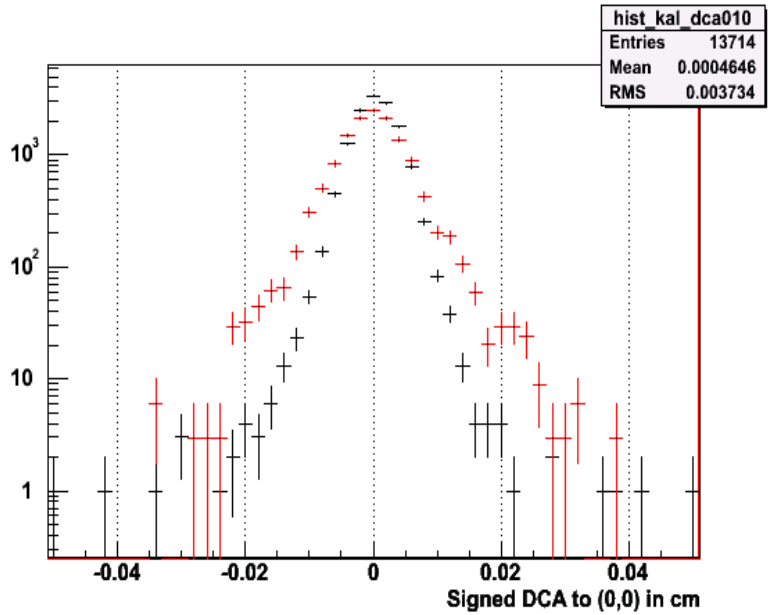
- Associate with one SVX hit on each of the 4 barrel layers
- Track quality = 31 or 63
- Pt (reconstructed) in the same range for all 3 kinds of events

DCA of single pi+ (Black) vs. decay K-/pi+ from D^0 (Red)

Old weight

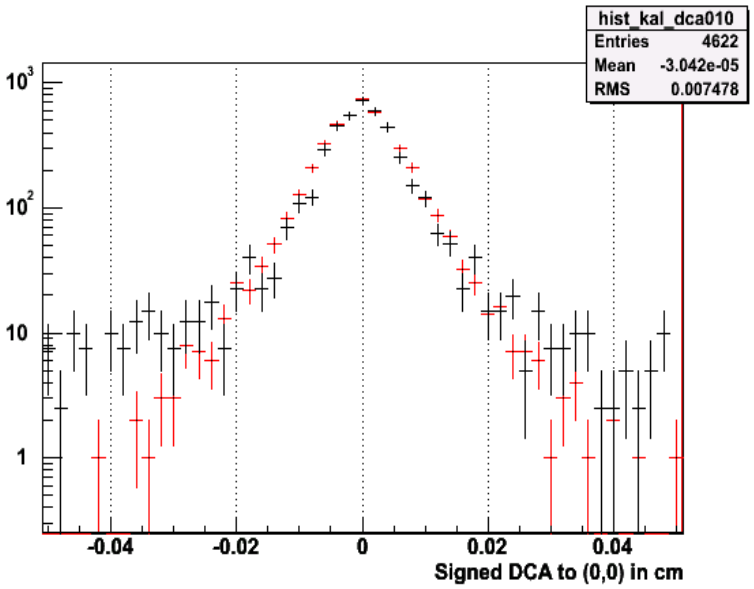


New weight



DCA of single pi+ in EXODUS(Black) vs. decay K-/pi+ from D^0 (Red)

Old weight



New weight

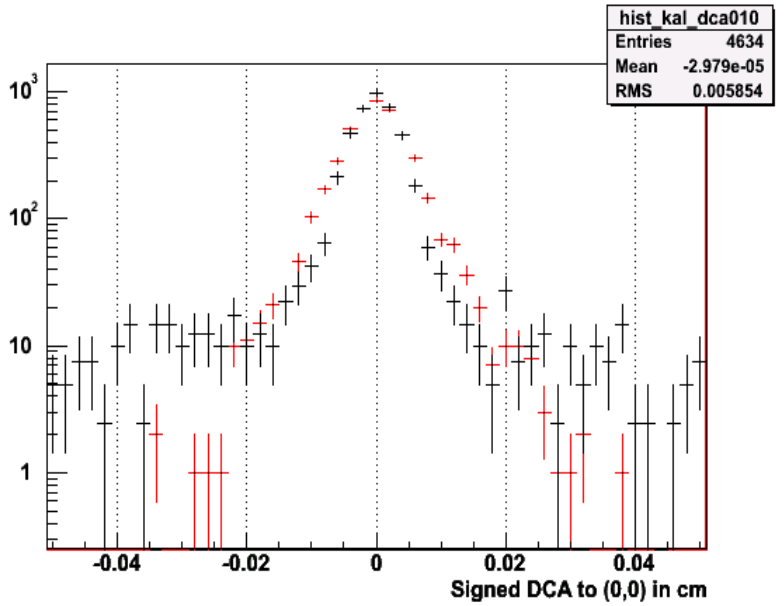


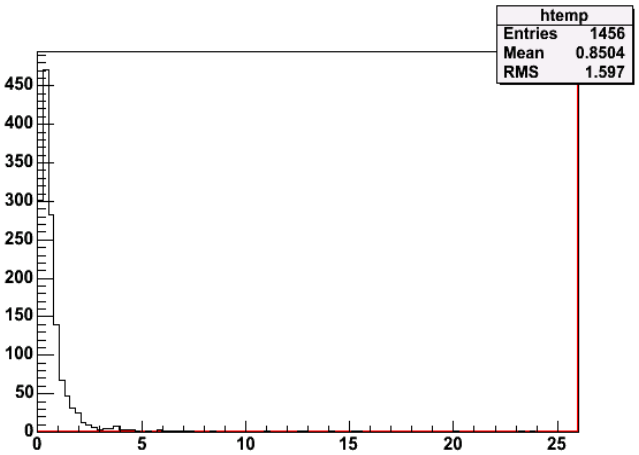
Table of Sigma from Fitting a Gaussian peak to the DCA distribution

	Data Source	Single pi+	Decay K-/pi+	EXODUS
Sigma (microns)				
Old Weight		44	61	54
New Weight		33	48	36

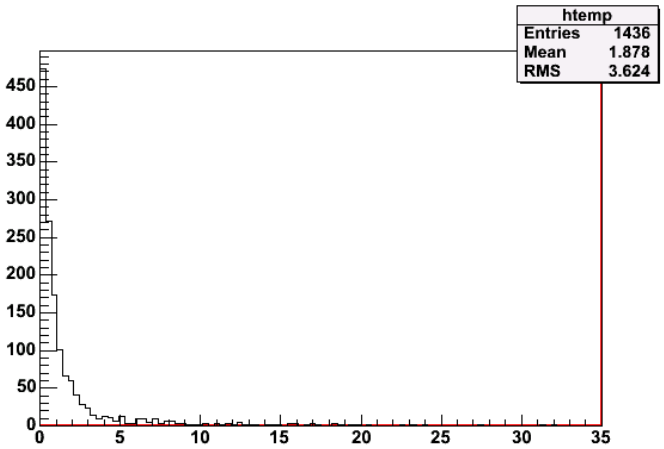
Yes, the peaks become narrower, approaching the SVX resolution. However, we also view broad tail on tracks from EXODUS, which is possible to happen in Au-Au. Could Kalman identify them? Let's look at the chi2 result of fitting.

The chi2 cut used in Kalman is
(total chi2) / (total DOF)

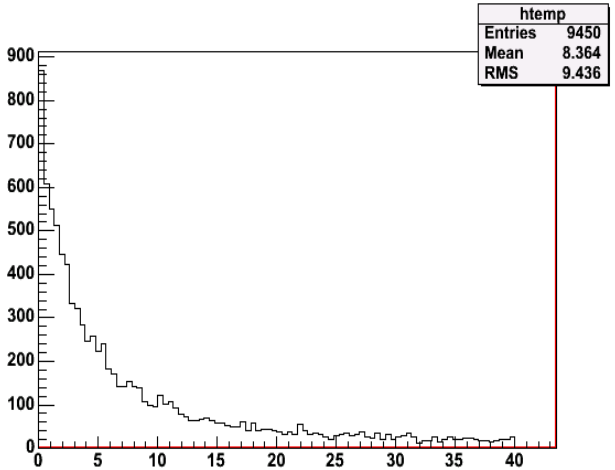
Chi2 distribution of tracks from 3 types of events



Single pi+



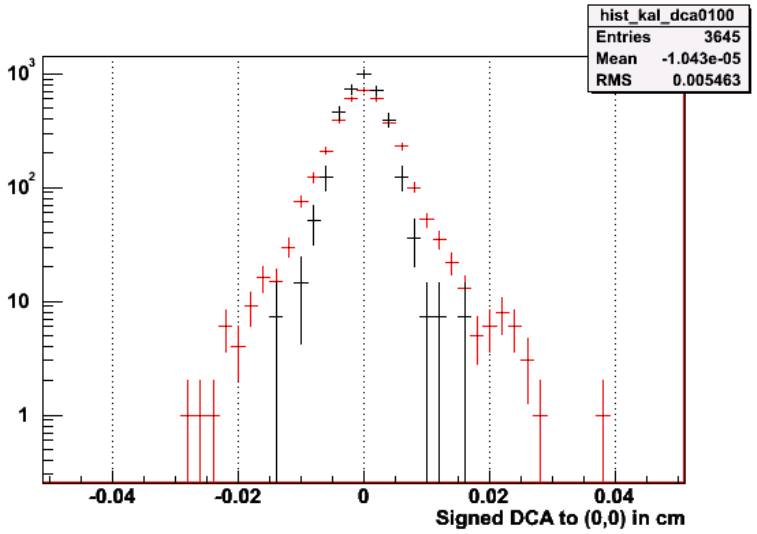
K-/pi+ from D^0



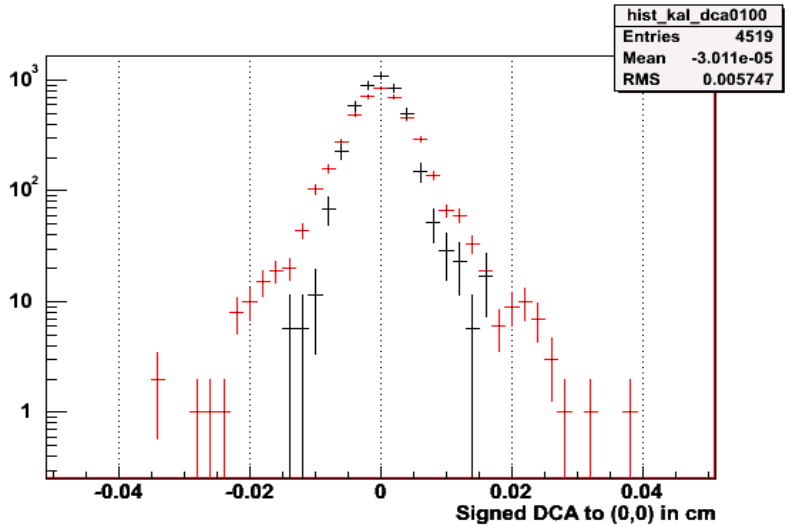
EXODUS

EXODUS pi+ (Black) vs. decay K-/pi+ (Red)
Chi2 cut the tail, while little change the sigma of Gaussian

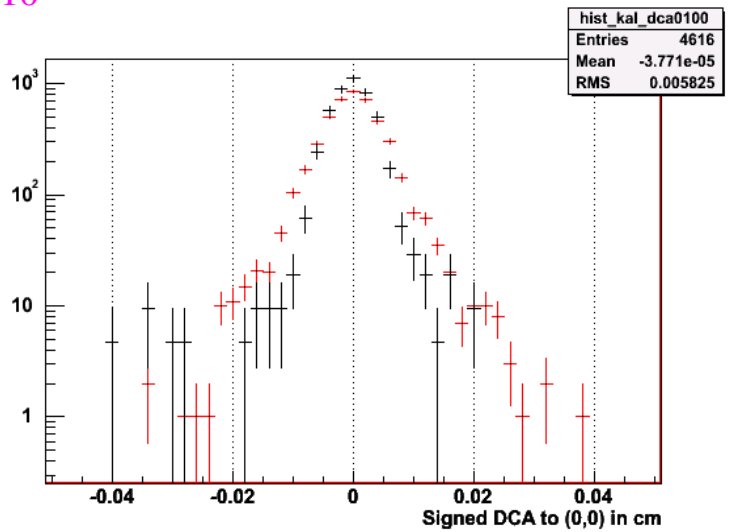
Chi2<1.0



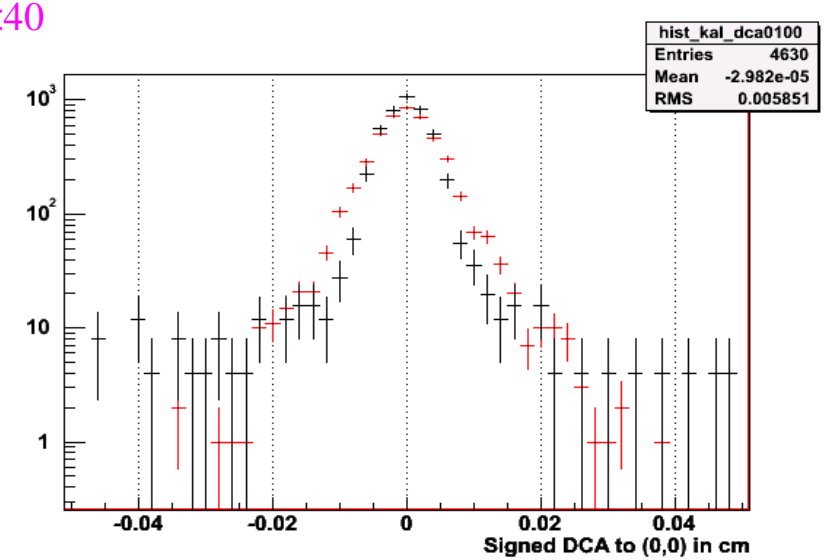
Chi2<3.0



Chi2<10

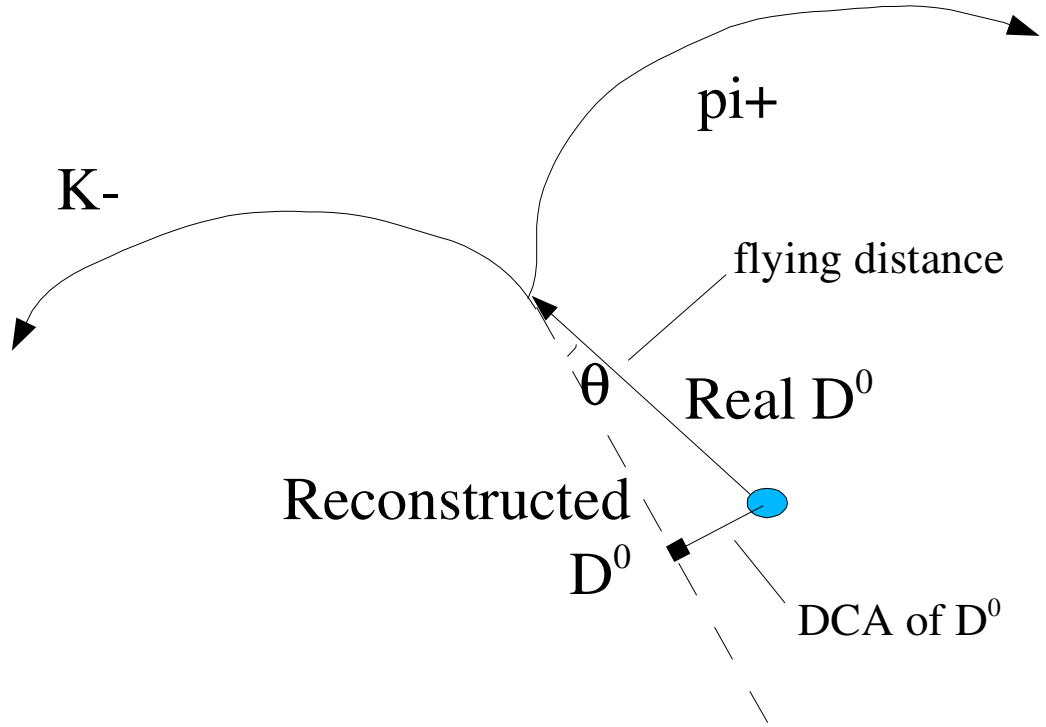


Chi2<40



Pair Cut for the reconstruced D^0 (combinatorics of unlike-charge pairs)

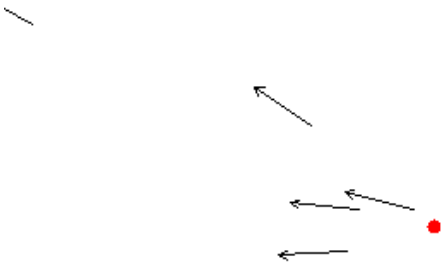
For those tracks pass single track quality cut, we can combine any unlike-charge pair to form a 'test' D^0. In reality, we will have 3 values for it: flying distance, θ and DCA, and DCA / d = sin(θ). For an ideal case, θ should be exactly zero.



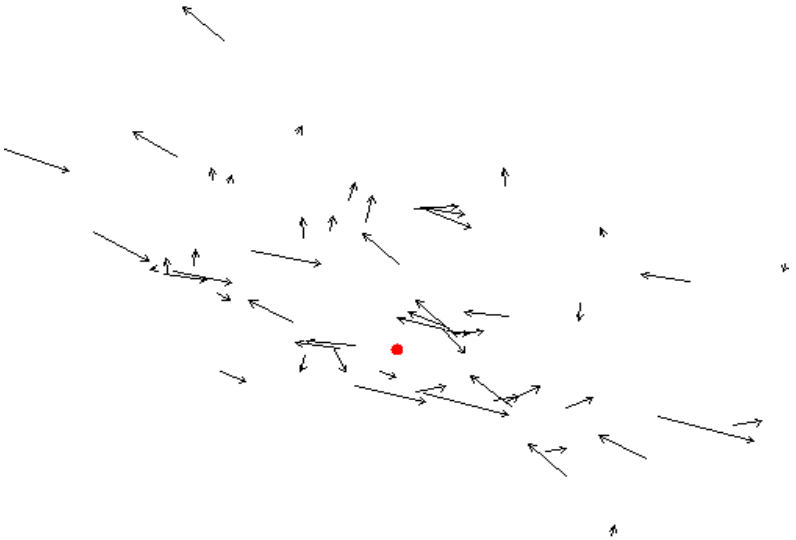
The reconstructed 'D^0'

Make tangent lines of each track at its closest point to collision vertex.
The cross-point of two lines will be the combinatorics, whose arrow starts from here, and its direction indicates the combinatorics Pt vector.

Unlike-pair from D^0 events
not necessarily K-/pi+

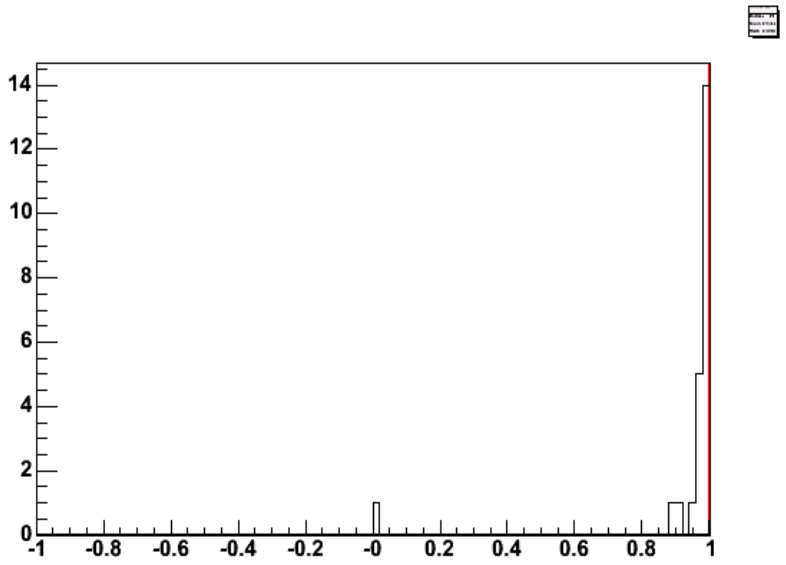


Unlike-pair from EXODUS

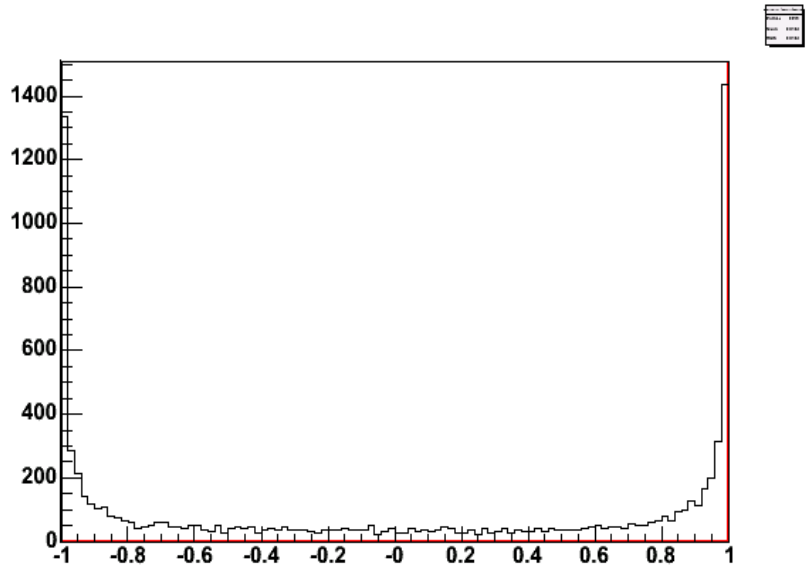


Each plot shows a range of 500um X 500um, and
the red point at center means collision vertex

So we see θ may not exactly be Zero. And combinatorics from real D^0 give a different θ distribution to those from EXODUS. To increase statistics, here we don't apply DCA cut to single tracks.



cos(θ) of combinatorics from D^0 event



cos(θ) of combinatorics from EXODUS event

Next jobs:

1. Verify the reconstruction of unlike-pairs.

2. Check how these cuts (DCA, cos(θ), etc) relate to each other.

3. Increase statistics